CLAIMS

What is claimed is:

Claim 1. A method for spatially reading handwritten symbols, the method comprising:

defining a spatial three dimensional volume;

deploying a writing tip within the spatial three dimensional volume;

writing a handwritten symbol with the writing tip;

measuring positions of the writing tip within the volume as the handwritten symbol is being executed;

measuring motions of the writing tip within the volume as the handwritten symbol is executed; and

identifying two dimensional handwritten symbols from the measured three dimensional positions and motions of the writing tip.

Claim 2. The method according to claim 1, wherein defining a spatial three dimensional volume comprises:

defining a plane corresponding to an X-Y plane;

locating an origin in space proximate the plane;

defining a Z-axis orthogonal to the X-Y plane; and

applying a reference coordinate system to define all points relative to one of the origin, the X-Y plane, the Z-axis, and angular relations corresponding to a position of the writing tip.

Claim 3. The method according to claim 2, wherein applying a reference coordinate system to define all points further comprises applying one of Cartesian coordinates, spherical coordinates, and cylindrical coordinates to the spatial three dimensional volume.

Claim 4. The method according to claim 1, wherein deploying a writing tip within the spatial three dimensional volume comprises inserting a writing stylus into a receptacle in a bracket mounted on a boom in a handwritten symbol reader.

Claim 5. The method according to claim 1, wherein writing a handwritten symbol with the writing tip comprises a user grasping a writing stylus and performing a writing upon a writing area of a handwritten symbol reader.

Claim 6. The method according to claim 1, wherein measuring positions of the writing tip within the volume comprises measuring changes in an electrical component over time as the writing tip is moved from position to position during a writing.

Claim 7. The method according to claim 6, wherein measuring positions of the writing tip within the volume further comprises measuring changes in an electrical component over time as the writing tip moves about with respect to a fixed position in space.

Claim 8. The method according to claim 6, wherein measuring changes in an electrical component further comprises measuring one of voltage, current, resistance, inductance, and impedance in real time.

Claim 9. The method according to claim 1, wherein measuring motions of the writing tip within the volume comprises measuring changes in an electrical component over time as the writing tip translates from position to position three-dimensionally during a writing.

Claim 10. The method according to claim 9, wherein measuring motions of the writing tip within the volume further comprises measuring changes in an electrical component over time as the writing tip traverses a three-dimensional path of motion with respect to a fixed position in space.

Claim 11. The method according to claim 9, wherein measuring changes in an electrical component further comprises measuring one of voltage, current, resistance, inductance, and impedance in real time.

Claim 12. The method according to claim 1, wherein identifying a two dimensional handwritten symbol from measured three dimensional positions and motions of the writing tip comprises determining measurement coordinates relative to a reader fulcrum pivot and an associated time coordinate.

Claim 13. The method according to claim 1, wherein identifying a two dimensional handwritten symbol from measured three dimensional positions and motions of the writing tip comprises:

aligning an X-Y plane adjacent a writing portion of a writing platform;

aligning a Z-axis with a ray pointing outward perpendicularly from the writing platform;

defining the origin to be apart from the writing platform; and

projecting the three dimensional position and motions onto a two dimensional plane.

Claim 14. The method according to claim 1, wherein identifying a two dimensional handwritten symbol from measured three dimensional positions and motions of the writing tip comprises:

measuring motions over time along two orthogonal axes of rotation and along a radial distance;

applying a rotary first measurement to span rotation in a projection plane over the flat surface of the platform;

applying a rotary second measurement to span an angular elevation from the projection plane; and

applying a radial third measurement of linear distance from a reader fulcrum pivot along the elevation.

Claim 15. A device for spatially reading handwritten symbols, the device comprising:

a platform having a flat surface; and

a spatial tracking assembly positioned adjacent to and rotatably engaging a planar writing area selected from the flat surface of the platform, the spatial tracking assembly being configured to slidably accept a writing stylus and to rotate with the stylus at least about an axis parallel to the flat surface; whereby a stylus tip of the writing stylus is adapted to trace a three dimensional path in a volume above the flat surface of the platform.

Claim 16. The device according to claim 15, wherein the spatial tracking assembly comprises:

a boom;

an assembly support pinion providing rotatable engagement with the flat surface of the platform;

a fulcrum housing having a fulcrum bracket connected to the assembly support pinion;

a fulcrum pinion rotatably engaging the fulcrum housing orthogonally to the assembly support pinion; and

a securing means for rotatably securing the spatial tracking assembly to the flat surface of the platform, the securing means comprising:

a restricting flange on one end of the assembly support pinion;

a locking feature on another end of the assembly support pinion; and

a locking member mating with the locking feature to lock the assembly support pinion in the platform, whereby the spatial tracking assembly is adapted to rotate at least two dimensionally with respect to the flat surface of the platform.

Claim 17. The device according to claim 16; wherein the boom comprises at least one elongated boom stem attached to the fulcrum pinion at one end of the at least one boom stem;

a tracking bracket slidably attached to the at least one boom stem; and

an opening on the tracking bracket, the opening serving as a receptacle for engaging the boom with the writing stylus, whereby three dimensional movement of the stylus tip is translated through movement of the tracking bracket with respect to the at least one boom stem into a two dimensional representation of a symbol.

Claim 18. The device according to claim 17; wherein the tracking bracket comprises:

a reference tracking point fixed relative to the stylus receptacle;

a reference position of the tracking bracket along the boom; and

a reference position of the boom, wherein the tracking point lies within the writing volume and the tracking point and reference positions define a three dimensional coordinate space in which the stylus tip moves.

Claim 19. The device according to claim 18; further comprising:

means for measuring time; and

means for measuring position, position measurement comprising:

measurement of a linear position along the boom;

measurement of an angular position, measurement of the angular position comprising:

measuring the angular position rendered by an angular position of the fulcrum pinion; and

measuring an angular position rendered by an angular position of the assembly support pinion, whereby time and position measurements are used to determine a dynamic state variable of the stylus tip and position of the stylus tip as a function of time.

Claim 20. The device according to claim 19, wherein position measurement further comprising:

measurement of a radial position of the boom, whereby radial position measurements are used to determine a dynamic state variable of the stylus tip and position of the stylus tip as a function of time.

Claim 21. The device according to claim 20, wherein position measurements are collected as tracking data, the tracking data comprising:

output of a linear position sensor, the linear position corresponding to translation of the sliding bracket along the at least one boom stem;

output of an angular position sensor, the angular position corresponding to an angle of the boom with respect to the writing surface; and

output of a radial position sensor, the radial position corresponding an angle of the boom with respect to a perpendicular axis related to the writing surface, whereby the tracking data is used to determine a dynamic state variable of the stylus tip and a position of the stylus tip as a function of time.

Claim 22. The device according to claim 21, wherein the tracking data comprises:

a set of position and time coordinates, wherein position coordinates are transformed to a spatially equivalent set of Cartesian coordinates;

a conical projection of the Cartesian coordinates onto the writing area;

a restriction of the conical projection, the restriction producing an image upon the writing area that is true to an image of a writing upon a traditional writing medium; and

an identification of the restriction with a projection pre-image in a writing volume of a true writing image, whereby three dimensional writing motions formed within the writing volume are identified and interpreted as two dimensional handwritten symbols in real time.